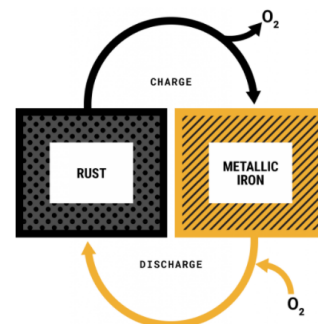


## CH692 W2D1

**1) Battery Electrode Chemistries.** Form Energy, based in Boston, is working to commercialize a low-cost grid-scale based battery. Their website shows the following:

### THE BATTERY CYCLE

- The basic principle of operation is reversible rusting
- While discharging, the battery breathes in oxygen from the air and converts iron metal to rust
- While charging, the application of an electrical current converts the rust back to iron and the battery breathes out oxygen



- Write a chemical equation for the battery.
- Is it a conversion, substitution or intercalation type battery reaction at the negative electrode?
- What is the reaction at the positive electrode?
- Can you write the overall chemical reaction as two half reactions? What are their standard reduction potentials?
- What is the voltage of the battery? How do you calculate this?
- What type of electrolyte do you think is used? Why?

**2) Dendrites.** Explain why dendrites form during metal electroplating using words and clear schematics. Discuss your schematic with your group.

- Explain the role of thermodynamics, kinetics, and transport in the formation of dendrites.
- Suggest ways to prevent the formation of dendrites. Under what charge and discharge conditions would dendrites be expected more likely to form?

**3) Insertion Electrodes.** Below is a voltammogram of a lithiated metal oxide in a Li<sup>+</sup> containing organic battery electrolyte.

- Based on this data, would this material be used as the positive or negative electrode of a Li-ion battery?
- What do the peaks correspond to on the positive and negative sweep? What is happening microscopically?
- What does "specific" mean on the y axis?

